

SYNOPSIS OF *PARELEDONE* AND *MEGALELEDONE* SPECIES,
WITH DESCRIPTION OF TWO NEW SPECIES
FROM EAST ANTARCTICA (CEPHALOPODA: OCTOPODIDAE)

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Abstract

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A synopsis is given for species of the genus *Pareledone* from Prydz Bay, Antarctica: *P. adeliaeana* (Berry, 1917), *P. charcoti* (Joubin, 1905), and *P. harrissoni* (Berry, 1917). Two new species of *Pareledone* are described and illustrated: *P. framensis* from Fram Bank, off MacRobertson Land, and *P. prydzensis* from Prydz Bay, off the Amery Ice Shelf, Antarctica. A comparative description of *Megaleledone senoi* Taki, 1961, from Antarctica is also provided.

Introduction

The taxonomy of Antarctic eledonine octopuses is poorly known. A literature review revealed that eight nominal species of *Pareledone* have been previously described from Antarctic waters (latitudes greater than 60°S). Several of the species (e.g., *Pareledone antarctica* (Thiele, 1920), *P. aurorae* (Berry, 1917), and *P. umitakae* Taki, 1961) were known only from type material, and most other species have not been reviewed in detail since Robson's (1932) monograph. Much of the past work on Antarctic octopods has concentrated on material from the Antarctic Peninsula vicinity, and little information has been published on the fauna of East Antarctica.

A study is now being undertaken to provide systematic information on octopods of the Prydz Bay region (around 68°S, 75°E). While attempting to identify the *Pareledone* specimens, it became clear that two previously undescribed species existed among the specimens collected. This paper describes the new species and provides a comparison with existing valid species of *Pareledone* from the region.

Voss (in Palacio, 1978) considered that *Megaleledone* (a monotypic genus) was a synonym of *Pareledone*, so the new species here diagnosed are also contrasted with *Megaleledone senoi* Taki, 1961. Further systematic information on the *Pareledone* and *Megaleledone* species will be provided with the future publication of a larger revision of the Octopodidae of the Prydz Bay region.

Material and methods

A collection of 125 eledonine octopuses from 41 stations on the continental shelf (water depths less than 1000m) has been accumulated during benthic surveys conducted by the Australian National Antarctic Research Expeditions (ANARE). Fauna has been sampled by beam or otter trawls and epibenthic sleds, during cruises of the MS *Nella Dan* (1985–1987) and RSV *Aurora Australis* (1990 onwards). Live octopuses were observed during the 1991 cruise of RSV *Aurora Australis* to Prydz Bay; these animals were then sacrificed using fresh water, fixed in formalin, and preserved in ethanol. A number of animals were autopsied for parasites and the material has been forwarded to appropriate researchers for identification and description.

Holotypes and most paratypes have been deposited at the Museum of Victoria; paratypes and other voucher specimens were deposited at the Australian Museum, and the National Museum of Natural History, Smithsonian Institution.

Efforts were made to verify most of the previous type and nontype records. Where specimens have not yet been available for study, or descriptions are not clear, the relevant entry in the synonymy has been denoted with a question mark (?).

Where there is sufficient material, counts and measurements are included for a representative 10 females and 10 males. Counts, measurements and indices were defined by Roper and Voss (1983) and Toll (1988) with the following exception: OASC — opposite arm sucker count in

males, or sucker count on either arm L3 or R3 in females. Materials studied, including type specimens, are from: The Australian Museum, Sydney (AM); Muséum National d'Histoire Naturelle, Paris (MNHN); Museum of Victoria, Melbourne (NMV); National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM).

Octopodidae

Pareledone Robson, 1932

Type species. Eledone charcoti Joubin, 1905.

Diagnosis. Benthic octopodids. Mantle saccular, without fins. Eight arms lacking cirri, arms with small uniserial suckers, third right arm of males hectocotylised with end of arm clearly differentiated into ligula and calamus, arms tips not otherwise modified. Web well developed. Funnel organ VV- or W-shaped. Gills well developed, with 6–9 lamellae. Ink sac present. Crop well developed. Radula normal, with multicuspid rhachidian, lateral teeth and marginal plates well defined. Cartilaginous stylets absent.

Pareledone adeliaana (Berry)

Figures 1, 9a–d

Moschites adeliaana Berry, 1917: 17, text figs 10–13, pl. 11 fig. 5, pl. 12 figs 6–8.

Pareledone adeliaana. — Robson, 1932: 278.

Pareledone adeliaana [sic]. — Dell, 1959: 92, text fig. 7. — Voss, 1988: 300 [designation of *nomen dubium*].

Pareledone unitakae Taki, 1961: 308, text figs 9–16, pl. 3.

Material examined. Holotype: Antarctica, off Mertz Glacier (66°55'S, 145°21'E), 288–300 m [527–549 m], SY *Aurora*, Stn 2, Australasian Antarctic Expedition, 28 Dec 1913, AM C40889 (submature ♀, 29.5 mm ML).

Other material examined: Antarctica, off Enderby Land: 65°50'S, 50°34'E, 540 m, MS *Nella Dan*, Stn HRD-011, ANARE, M. D. Norman, 20 Nov 1985, NMV F65629 (submature ♀, 17.7 mm ML); 65°56'S, 50°52'E, 386–400 m, MS *Nella Dan*, Stn HRD-010, ANARE, M. D. Norman, 15 Nov 1985, NMV F65628 (mature ♂, 54.5 mm ML).

Off MacRobertson Coast: 67°15'S, 68°56'E, 139 m, RSV *Aurora Australis*, Stn AA91-99, ANARE, C. C. Lu and T. N. Stranks, 28 Feb 1991, NMV F65611 (immature ♂, 36.0 mm ML); 67°15'S, 70°07'E, 172–182 m, RSV *Aurora Australis*, Stn AA91-95, ANARE, C. C. Lu and T. N. Stranks, 26 Feb 1991, NMV F65670 (immature ♂, 24.8 mm ML); 67°07'S, 70°17'E, 256 m, ANARE, 2 Feb 1986, NMV F65627 (mature ♂, 59.0 mm ML); 67°03'S, 70°24'E, 242–244 m, RSV *Aurora Australis*, Stn AA91-96, ANARE, C. C. Lu and T. N. Stranks, 26 Feb 1991, NMV F65669 (immature ♂, 28.4 mm ML); 66°53'S, 70°44'E, 444–453 m, RSV *Aurora Australis*, Stn AA91-97, ANARE, C. C. Lu and T. N. Stranks, 26 Feb 1991, NMV F65668 (submature ♀, 26.7 mm ML).

Off Amery Ice Shelf, Prydz Bay: 67°42'S, 71°56'E,

667–676 m, RSV *Aurora Australis*, Stn AA91-92, ANARE, C. C. Lu and T. N. Stranks, 25 Feb 1991, NMV F65613 (immature ♂, 29.0 and 31.4 mm ML); 66°48'S, 72°33'E, 526–532 m, RSV *Aurora Australis*, Stn AA91-89(2), ANARE, C. C. Lu and T. N. Stranks, 24 Feb 1991, NMV F65630 (submature ♀, 21.7, 23.5, 27.1, 30.5, 35.1, 35.7, 39.6 mm ML; mature ♀, 46.8 mm ML; spent ♀, 43.1 mm ML; immature ♂, 25.4, 27.6, 29.7, 47.4 mm ML; mature ♂, 38.3, 40.8 mm ML), USNM 884248 (mature ♂, 44.8 mm ML); 66°59'S, 72°37'E, 532–536 m, RSV *Aurora Australis*, Stn AA91-90, ANARE, C. C. Lu and T. N. Stranks, 24 Feb 1991, NMV F65671 (submature ♀, 23.3 mm ML); 67°56'S, 76°24'E, 436–441 m, RSV *Aurora Australis*, Stn AA91-77, ANARE, C. C. Lu and T. N. Stranks, 18 Feb 1991, NMV F65612 (immature ♂, 40.5 mm ML).

Diagnosis. Medium sized animals (ML to 55 mm; TL to 160 mm) (fig. 1); mantle elongate ovoid (MWI 62.7–76.1–91.1); head wide, usually slightly wider than mantle (HWI 67.8–77.3–91.6), demarked from mantle by moderate constriction; eyes very large, project above surface of head. Funnel large, stout, bluntly tapered (FuLI 29.1–34.4–41.3); funnel organ W-shaped, limbs thick, outer limbs as long as median limbs (fig. 9c). Mantle aperture very wide (PAI 93.6–104.3–128.2). Arms short (MAI 45.3–58.4–81.5) (1.9–2.2 times ML in mature animals), stout, tapering to narrow tips. Arm lengths subequal, arm order usually 4.3.2.1 (ALI, arm 1: 112.9–154.6–205.2; arm 2: 115.0–161.8–216.5; arm 3: 117.6–165.0–214.2; arm 4: 112.4–168.1–221.0). Arm suckers uniserial, raised from arm surface, small (ASI 4.3–6.8–10.1), without sucker enlargement. Third right arm of males hectocotylised, shorter than its opposite number (OAI 81.2–91.5–98.0; HcAI 131.0–156.1–171.0); ligula medium size, 9–15% of third right arm length in mature animals (LLI 9.7–12.8–15.0); ligula groove long, well marked and deep, with approximately 8 transverse ridges; calamus long, pointed (CaLI 45.1–45.4–46.6) (figs 9a, b); hectocotylised arm with 22–28 suckers; opposite arm with 26–46 suckers. Web moderately deep (WDI 21.2–27.1–32.5), web formula usually B=C=DAE. Ink sac present. Gill lamellae 6–7. Mature ovarian eggs, from female with enlarged ovary, large (8–9 mm long, 3–4 mm wide) (EgLI 17.3–17.9–18.4; EgWI 7.1–7.3–7.5). Male with long penis (PLI 25.7–29.9–39.5), with single coiled diverticulum (fig. 9d); spermatophores moderately long (SpLI 58.7–66.9–78.7), slender (SpWI 4.9–5.5–6.2), with large, coiled sperm reservoir (SpRI 33.3–40.0–45.0).

Integumental sculpture consists of pattern of fine, rounded and widely scattered papillae on



Figure 1. *Pareledone adelicana* (Berry): a, dorsal, and b, lateral, view of USNM 884248, ♂, 44.8mm ML.

dorsal surface; papillae absent from ventral surface. Large unbranched primary papillae present in ocular region, with one large supraocular papilla. Two short, longitudinal integumentary ridges present on mid-dorsal posterior mantle. Ventrolateral integumentary ridge around mantle circumference present. In life, colour of resting animals uniformly purple–pink to purple–grey dorsally, white to cream–white ventrally. When stimulated, animals become darker in colour, uniformly purple–red to purple–brown dorsally, cream–white ventrally. White spots consist of one spot on mid-dorsal brachial crown, and one broad spot on mid-dorsal mantle. White transverse bar present between eyes. Ocelli absent.

Males mature at approximately 40 mm ML. Females attain ovarian maturity at about 45 mm ML.

Distribution. East Antarctica, from off Dronning Maud Land (67°52'S, 33°14'E) (Taki, 1961); from off Enderby Land (65°50'S to 65°56'S, 50°34'E to 50°52'E), off MacRobertson Land (66°53'S to 67°15'S, 68°56'E to 70°44'E), off the Amery Ice Shelf, Prydz Bay (66°48'S to 67°56'S, 71°56'E to 76°24'E) (this study); and from off the Mertz Glacier (66°55'S, 145°21'E) (Berry, 1917). Other published records need to be verified, but the species is probably restricted in distribution to East Antarctic waters. The species has been collected from the Antarctic continental shelf at depths ranging from 139–680 m, with temperatures from -2.2 to -1.7°C, on mud and sand bottoms with pebbles and rocks, and among sponges, bryozoans and gorgonaceans.

Remarks. Voss' (1988) designation of *Pareledone adelicana* as a *nomen dubium* appeared without justification for the decision, and it is unclear whether he studied material first-hand. The holotype of *P. adelicana* (Berry) was examined for the present study. The mantle was found to be distorted through preservation and contracted longitudinally, resulting in the mantle length being much shorter (and the mantle width much wider) than would have existed in the live animal. The typical morphology, with the very large eyes, wide head and narrow elongate mantle, is shown in Fig. 1. Additional morphological measurements and counts of the type have permitted the species to be clearly characterised. The two syntypes of *P. umitakae* Taki have not been available for study. The material may still be extant in the Taki family collection at Kyoto, Japan (T. Kubodera, National Science Museum,

Tokyo, pers. comm.). However, Taki's (1961) detailed description leaves us in no doubt that *P. umitakae* is a junior synonym of *P. adelicana*.

P. adelicana does not appear to be closely related to the other species of *Pareledone* described here. The elongate mantle, wide head, very large eyes, W-shaped funnel organ, short and stout arms, and ribbed ligula groove of *P. adelicana* are at the extremes of the morphological ranges of *Pareledone* species in general. In the future, removal of this species from the *Pareledone* genus may be justified.

Pareledone charcoti (Joubin)

Figures 2, 9e–h

Eledone charcoti Joubin, 1905: 22, pl. 3 figs 1, 2. — Joubin, 1906: 2, pl. 1 figs 1, 2. — ?Joubin, 1914: 35, text figs 1, 2. — ?Odhnir, 1923: 6.

[?] *Moschites charcoti*. — Hoyle, 1912: 97, text figs 6, 7. — Massy, 1916: 151, text figs 12–21.

Moschites aurorae Berry, 1917: 20, text figs 14–20, pl. 12 fig. 9, pl. 13 figs 10–12 [also refer to postscript, 1918].

[?] *Graneledone charcoti*. — Robson, 1930: 388.

[?] *Pareledone charcoti*. — Robson, 1932: 270. — Dell, 1959: 93, text figs 4–6. — Roper et al., 1985: 200. — Okutani, 1986: 279, pl. 3 figs 25, 26. — Dong, 1991: 183, text fig. 1.

Material examined. Lectotype (designated by Robson, 1932): Antarctica, off Graham Land, Booth Island [65°05'S, 63°55'W] [as 'Ile Wandel, Antarctique'], on the beach among algae and pebbles, 'Français,' Expedition Antarctique Française, 3 Sep 1904, MNHN 5–7–1095 (submature ♀, 33.8 mm ML).

Other material examined: Antarctica, off Queen Mary Land (66°08'S, 94°17'E), 120 fm, [220 m], SY *Aurora*, Stn 8, Australasian Antarctic Expedition, 27 Jan 1914, AM C40891 (immature ♂, 27.7 mm ML) (holotype of *Moschites aurorae* Berry, 1917).

Off Enderby Land: 65°56'S, 50°52'E, 386–400 m, MS *Nella Dan*, Stn IIRD-10, ANARE, M. D. Norman, 15 Nov 1985, NMV F65688 (submature ♀, 16.4 and 31.3 mm ML; immature ♂, 16.7 and 18.4 mm ML).

Off MacRobertson Land: 66°59'S, 62°49'E, 117 m, ANARE, 6 Feb 1986, NMV F65689 (submature ♀, 38.7 and 39.6 mm ML; immature ♂, 30.6 mm ML; mature ♂, 46.8 and 65.1 mm ML); Horseshoe Harbour, Mawson Station [67°40'S, 63°00'E], ANARE, J. S. Bunt, 16 Jan 1957, NMV F23493 (♂, 40.2 mm ML); Horseshoe Harbour, Mawson Station [67°40'S, 63°00'E], ANARE, 10 Mar 1960, NMV F22851 (mature ♀, 52.8 mm ML); 67°18'S, 65°34'E, 110 m, ANARE, 3 Dec 1982, NMV F65690 (submature ♀, 26.5 mm ML); 67°07'S, 70°17'E, 256 m, ANARE, 2 Feb 1986, NMV F65691 (mature ♂, 47.7 mm ML).

Off Amery Ice Shelf, Prydz Bay: 67°19'S, 71°25'E, 562–567 m, MS *Nella Dan*, Stn Prydz-87-27, ANARE, T. G. Cochran, 22 Feb 1987, NMV F65693 (submature ♀, 36.0 mm ML); 66°48'S, 72°33'E, 526–532 m, RSV *Aurora Australis*, Stn AA91-89(2), ANARE, C. C. Lu and T. N. Stranks, 24 Feb 1991, NMV F67885 (immature ♂, 29.2 and 34.6 mm ML);

68°03'S, 73°13'E, 680–683 m, RSV *Aurora Australis*, Stn AA91-84, ANARE, C. C. Lu and T. N. Stranks, 21 Feb 1991, NMV F65698 (mature ♀, 64.5 mm ML); 68°26'S, 75°24'E, 616–622 m, RSV *Aurora Australis*, Stn AA91-78, ANARE, C. C. Lu and T. N. Stranks, 19 Feb 1991, NMV F65695 (mature ♂, 52.7 mm ML); 67°56'S, 76°24'E, 436–441 m, RSV *Aurora Australis*, Stn AA91-77, ANARE, C. C. Lu and T. N. Stranks, 18 Feb 1991, NMV F65697 (mature ♂, 35.5 mm ML); 67°21'S, 77°19'E, 333–341 m, RSV *Aurora Australis*, Stn AA91-75, ANARE, C. C. Lu and T. N. Stranks, 17 Feb 1991, NMV F65696 (submature ♀, 18.7 mm ML; immature ♂, 23.1 mm ML); 67°21'S, 77°20'E, 337–343 m, MS *Nella Dan*, Stn Prydz-87-40, ANARE, T. G. Cochran, 27 Feb 1987, NMV F65694 (mature ♀, 53.3 mm ML), USNM 884247 (mature ♂, 45.7 mm ML); 67°33'S, 77°30'E, 298–301 m, RSV *Aurora Australis*, Stn AA91-76, ANARE, C. C. Lu and T. N. Stranks, 18 Feb 1991, NMV F67888 (submature ♀, 24.7 mm ML; immature ♂, 18.3 mm ML); 67°02'S, 78°15'E, 251–266 m, RSV *Aurora Australis*, Stn AA91-74, ANARE, C. C. Lu and T. N. Stranks, 17 Feb 1991, NMV F67887 (mature ♂, 34.6 mm ML).

Diagnosis. Medium sized animals (ML to 65 mm; TL to 210 mm) (fig. 2); mantle spherical (MWI 83.3–92.7–101.2); head moderately wide, narrower than mantle (HWI 55.5–69.8–82.6), demarked from mantle by moderate constriction; eyes large, project above surface of head. Funnel large, stout, bluntly tapered (FuLI 35.6–40.9–47.6); funnel organ VV-shaped, limbs thick, outer limbs as long as median limbs (fig. 9g). Mantle aperture very wide (PAI 80.9–100.6–122.2). Arms short (MAI 48.1–57.3–74.2) (1.5–2.3 times ML in mature animals), stout, tapering to fine tips. Arm lengths subequal, arm order usually 4.3.2.1 (ALI, arm 1: 118.8–159.3–187.3; arm 2: 119.6–166.0–200.0; arm 3: 129.8–169.9–204.2; arm 4: 128.0–173.5–207.8). Arm suckers uniserial, raised from arm surface, small (ASI 4.9–6.6–10.9), without sucker enlargement. Third right arm of males hectocotylised, shorter than its opposite number (OAI 87.6–90.3–92.4; HcAI 124.7–158.3–177.5); ligula medium size, 5–9% of third right arm length in mature animals (LLI 5.0–6.6–8.1); ligula groove long, well marked and shallow, without transverse ridges; calamus long, pointed (CaLI 34.8–47.5–66.7) (figs 9e, f); hectocotylised arm with 31–38 suckers; opposite arm with 37–54 suckers. Web moderately deep (WDI 23.0–30.6–44.8), web formula usually $B=C=DAE$. Ink sac present. Gill lamellae 7–8. Mature ovarian eggs, from females with enlarged ovaries, large (11–14 mm long, 5–7 mm wide) (EgLI 18.1–21.1–23.8; EgWI 7.9–9.9–11.4). Male with long penis (PLI 21.7–37.4–46.5), with single coiled diverticulum (fig. 9h); spermatophores long (SpLI 55.5–139.7–164.5),

slender (SpWI 4.0–4.5–5.0), with large, coiled sperm reservoir (SpRI 26.4–30.3–32.8).

Integumental sculpture consists of pattern of fine, rounded and closely set papillae on dorsal surface; papillae absent from ventral surface. Large unbranched primary papillae present in ocular region, with one supraocular papilla. Ventrolateral integumentary ridge present. In life, colour of resting animals uniformly pink-brown to purple-brown dorsally, cream-white ventrally. When stimulated, animals become darker in colour, dark purple-brown dorsally, cream-white ventrally. Papillae on dorsum usually slightly darker than background, giving spotted appearance. White spots consist of one spot on mid-dorsal brachial crown, and one broad spot on mid-dorsal posterior mantle. White transverse bar present between eyes. Ocelli absent.

Males mature at approximately 35 mm ML. Females attain ovarian maturity at about 55 mm ML.

Distribution. East Antarctica, from off Enderby Land (65°56'S, 50°52'E), off MacRobertson Land (66°59'S to 67°40'S, 62°49'E to 65°34'E), off the Amery Ice Shelf, Prydz Bay (66°48'S to 68°26'S, 71°25'E to 78°15'E) (this study); and off Queen Mary Land (66°08'S, 94°17'E) (Berry, 1917). West Antarctica, from off Graham Land (65°05'S, 63°55'W) (Joubin, 1905). Other distributional records remain to be verified, but the species probably has a circumpolar distribution. The species has been collected on the Antarctic continental shelf at depths ranging from 110–683 m, with temperatures from -2.1 to -1.6°C, on mud and sand bottoms with pebbles and rocks, and among sponges, gorgonaceans and bryozoans.

Remarks. *P. charcoti*, along with *P. harrissoni* (Berry), are probably the most commonly-occurring elledonines in East Antarctic waters. The present material provides a comprehensive series of life history stages, including mature males and females.

Examination of the type specimen of *P. auro-rae* (Berry) allowed us to check Berry's (1918 postscript) suspicion that the species was conspecific with *P. charcoti*. The holotype of *P. auro-rae* is an immature male, not a mature animal as Berry (1917) stated. Through dehydration of the type specimen over time, some shrivelling of the arm tips including the hectocotylised arm tip has occurred. Our present study has shown that the morphological counts and measurements for *P. auro-rae* fall within the ranges of variation known for *P. charcoti*, and we therefore confirm that the two species are synonymous.



Figure 2. *Pareledone charcoti* (Joubin): a, dorsal, and b, lateral, view of NMV F65695, ♂, 52.7 mm ML.

Pareledone framensis sp. nov.

Figures 3, 4, 9i-l

Material examined. Holotype: Antarctica, off MacRobertson Land, Fram Bank (67°29'S, 68°50'E), 145–150m, RSV *Aurora Australis*, Stn AA91-100, ANARE, C. C. Lu and T. N. Stranks, 28 Feb 1991, NMV F65665 (mature ♂, 58.9mm ML) (preserved in ethyl alcohol).

Paratypes: locality as above, AM C173818 (mature ♂, 67.6mm ML), NMV F65667 (mature ♂, 62.9mm ML), USNM 884250 (mature ♂, 53.8mm ML).

Other material examined: Antarctica, off MacRobertson Land, Fram Bank: 67°29'S, 68°50'E, 145–150m, RSV *Aurora Australis*, Stn AA91-100, ANARE, C. C. Lu and T. N. Stranks, 28 Feb 1991, NMV F65618 (immature ♂, 18.4mm ML); 67°11'S, 69°15'E, 307–319m, MS *Nella Dan*, Stn Prydz-87-23, ANARE, T. G. Cochran, 21 Feb 1987, NMV F65619 (submature ♀, 33.4mm ML; mature ♂, 61.0mm ML); 67°15'S, 70°06'E, 172–182m, RSV *Aurora Australis*, Stn AA91-95, ANARE, C. C. Lu and T. N. Stranks, 26 Feb 1991, NMV F65621 (submature ♀, 17.7mm ML); 67°25'S, 70°20'E, 161–165m, RSV *Aurora Australis*, Stn AA91-94, ANARE, C. C. Lu and T. N. Stranks, 26 Feb 1991, NMV F65620 (immature ♂, 25.2mm ML).

Diagnosis. Medium sized animals (ML to 70mm; TL to 280mm) (figs 3, 4a); mantle spherical (MWI 80.7–91.2–99.6); head moderately wide, narrower than mantle (HWI 52.7–63.4–75.0), demarked from mantle by moderate constriction; eyes large, project above surface of head. Funnel large, stout, bluntly tapered (FuLI 35.2–39.5–43.5); funnel organ VV-shaped, limbs thick, outer limbs three-quarters as long as median limbs (fig. 9k). Mantle aperture wide (PAI 76.2–90.0–106.3). Arms long (MAI 29.0–34.2–38.3) (2.7–3.4 times ML in mature animals), stout, tapering to fine tips. Arm lengths subequal, arm order usually 4.3.2.1 (ALI, arm 1: 195.9–261.3–312.9; arm 2: 218.0–265.7–321.0; arm 3: 227.5–268.4–310.0; arm 4: 258.9–285.4–345.1). Arm suckers uniserial, raised from arm surface, small (ASI 4.7–6.5–9.9), without sucker enlargement. Third right arm of males hectocotylised, shorter than its opposite number (OAI 74.2–80.5–91.4; HcAI 178.4–210.2–241.8) (fig. 4b); ligula medium size, 5–8% of third right arm length in mature animals (LLI 5.9–6.4–7.5); ligula groove long, well marked and shallow, without transverse ridges; calamus long, pointed (CaLI 35.6–47.9–56.5) (figs 9i, j); hectocotylised arm with 44–51 suckers; opposite arm with 61–80 suckers. Web shallow (WDI 12.2–17.4–22.6), web formula usually DCBAE. Radula with A₃–5 seriation of the rhachidian (fig. 4f). Ink sac present. Gill lamellae 7–8. Size of mature eggs unknown. Male with long penis

(PLI 38.9–40.9–43.1), with single coiled diverticulum (fig. 9l); spermatophores long (SpLI 123.2–138.7–167.7), slender (SpWI 3.8–4.5–5.5), with large, coiled sperm reservoir (SpRI 39.4–41.7–43.8).

Integumental sculpture consists of pattern of coarse, rounded and closely set papillae evenly covering dorsum, ventrum, and oral surface of web and lateral surfaces of arms. Large unbranched primary papillae present in ocular region, with one very large supraocular papilla, and on dorsal mantle with four papillae in diamond pattern. Ventrolateral integumentary ridge absent. In life, colour of resting animals uniformly yellow-brown to gold dorsally, white to cream-white ventrally. When stimulated, animals become darker in colour, uniformly golden-brown dorsally, and yellow-brown ventrally. White spots consist of one spot on lateral head, just ventral to each eye; and streak on the lateral mantle, posterior to each eye. White transverse bar present between eyes. Dorsal mantle and frontal white spots absent. Lateral head white spots and head bar conspicuous in live animals, often faded and inconspicuous in preserved animals. Ocelli absent.

Males mature at approximately 50–55mm ML. No mature females were encountered.

Distribution. Known only from Fram Bank, off MacRobertson Land, East Antarctica (67°11'S to 67°29'S, 68°50'E to 70°20'E). An inshore species collected at depths ranging from 145–319m, with temperatures from -2.2 to -2.1°C, on mud bottom with pebbles and rocks, and among sponges and ascidians.

Etymology. Named after the type locality, Fram Bank.

Remarks. This new species can be distinguished from all other valid congeners of *Pareledone* (listed in Table 1) by, among other characters, coarse papillation over the entire surface, and the colour pattern of gold with white spots and streaks. Additionally, this species can be distinguished from *P. adelieana* (Berry, 1917) by the narrower head width, the longer relative arm length, a higher sucker count on the hectocotylised arm (HASC) and opposite arm (OASC), the shorter ligula length index, the ligula groove without transverse ridges, and a VV- rather than W-shaped funnel organ. *P. framensis* also differs from *P. charcoti* (Joubin, 1905) by the longer relative arm length, a higher HASC and OASC, and the lack of a ventrolateral

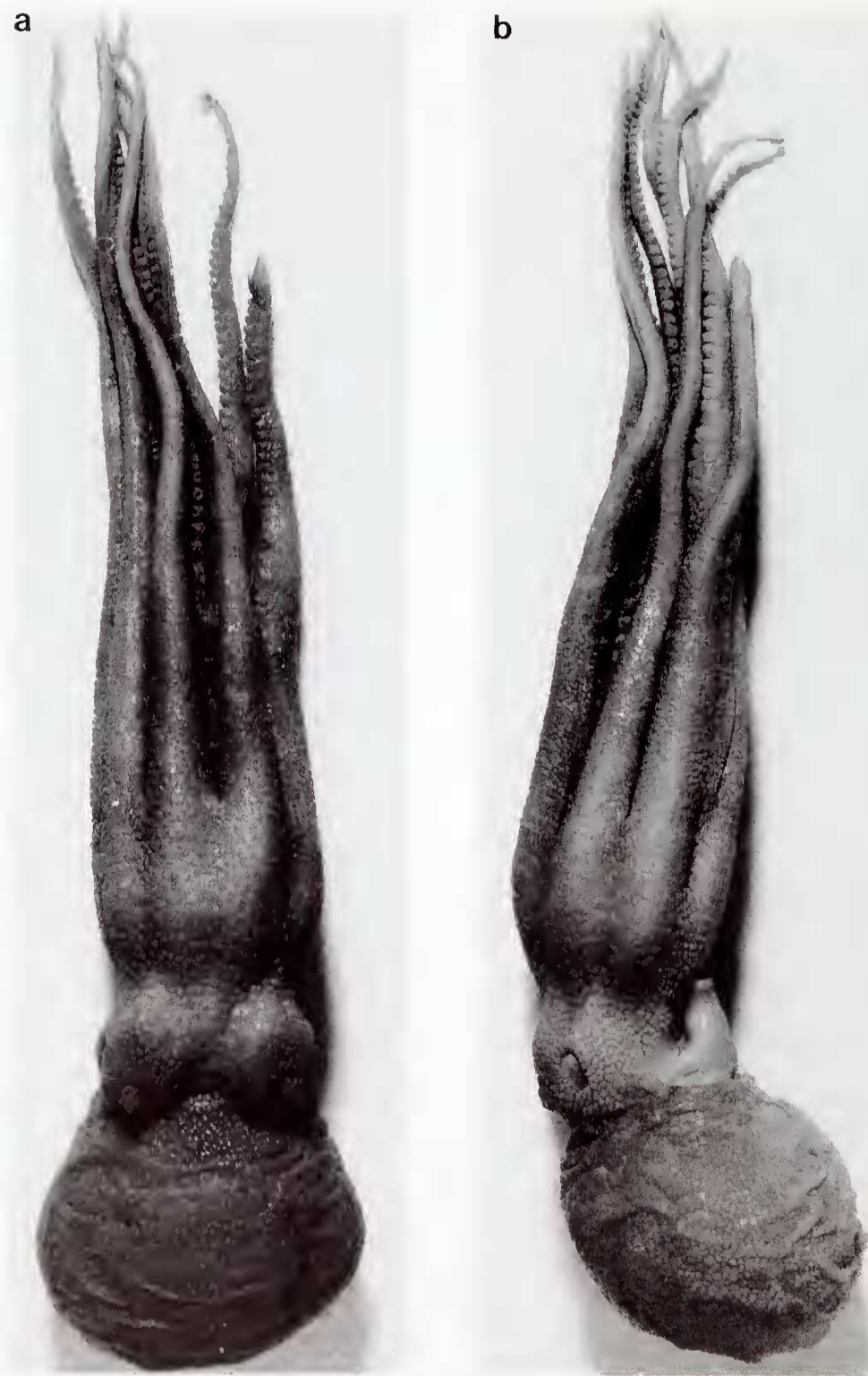


Figure 3. *Paraledone framensis* sp. nov.: a, dorsal, and b, lateral, view of USNM 884250, paratype, ♂, 53.8 mm ML.

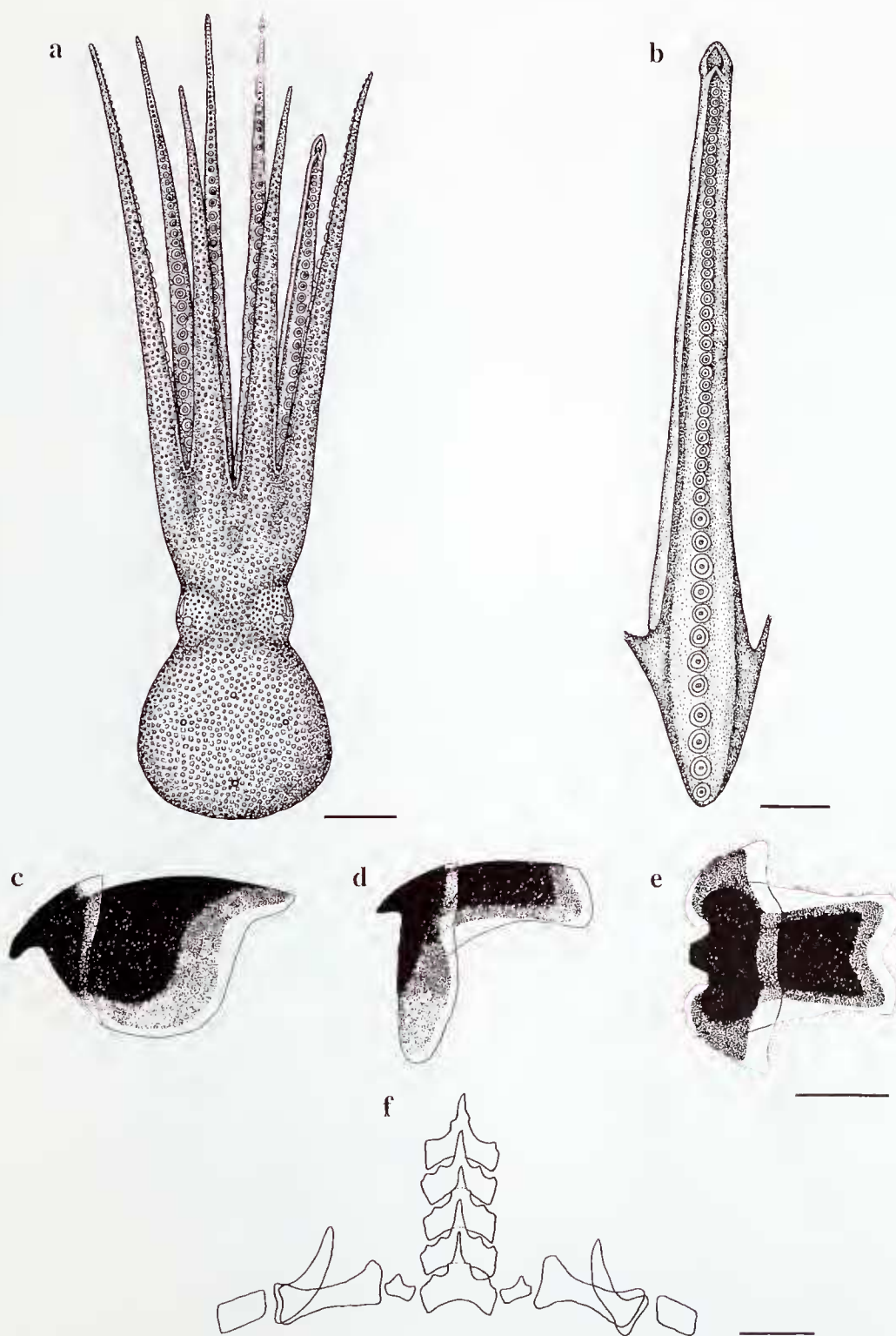


Figure 4. *Pareledone framensis* sp. nov.: a, dorsal view of holotype, NMV F65665, ♂, 58.9 mm ML (scale bar = 20 mm); b, hectocotyliised arm of NMV F65619, 61.0 mm ML (scale bar = 10 mm); c, upper beak, d and e, lower beak (scale bar = 2 mm), and f, radula (scale bar = 0.5 mm), of paratype, AM C173818, ♂, 67.6 mm ML.

integumentary ridge. It also differs from *P. harrissoni* (Berry, 1917) by having a narrower head width (see fig. 9; Tables 2, 3).

P. framensis can be distinguished easily from other eledonine species by a combined suite of characters including: a broadly ovoid mantle; skin with a characteristic pattern of coarse papillation on the dorsal, ventral and oral surfaces, but no ventrolateral ridge; large and prominent eyes; long, subequal arms (2.7–3.4 times ML in mature animals); small suckers; a shallow web (12–23% of arm length); a medium sized ligula (5–8% of third right arm length in mature animals), and 7–8 gill lamellae.

Pareledone harrissoni (Berry)

Figures 5, 9m–p

Moschites harrissoni Berry, 1917: 24, text figs 21–25, pl. 13 fig. 13, pl. 14 figs 14–16.

[?] *Moschites antarcticus* Thiele, 1920: 434, pl. 52 figs 1, 2.

Pareledone harrissoni. — Robson, 1932: 277. — ?Dell, 1959: 92, text figs 1–3.

[?] *Pareledone antarctica*. — Robson, 1932: 279.

Pareledone harrissoni [sic]. — Voss, 1988: 300 [designa-tion of *nomen dubium*].

Material examined. Holotype: Antarctica, off Shackleton Ice Shelf (65°06'S, 96°13'E), 325 fm [595 m], SY *Aurora*, Stn 10, Australasian Antarctic Expedition, 29 Jan 1914, AM C40892 (submature ♀, 53.8 mm ML).

Paratypes: Antarctica, 'Western Base' [66°20'S, 95°00'E], 270 fm [494 m], Australasian Antarctic Expedition, Jan 1913, AM C40893 (submature ♀, 62.2 mm ML); off Shackleton Ice Shelf (66°44'S, 97°28'E), 358 fm [654 m], SY *Aurora*, Stn 11, Australasian Antarctic Expedition, 31 Jan 1914, USNM 815724 (♀, 54 mm ML, not seen).

Other material examined: Antarctica, off MacRobertson Land: 66°59'S, 62°49'E, 117 m, ANARE, 6 Feb 1986, NMV F65678 (submature ♀, 74.5 mm ML); 67°18'S, 65°34'E, 110 m, ANARE, 3 Dec 1982, NMV F65679 (submature ♀, 23.2 and 59.7 mm ML); 67°29'S, 68°50'E, 145–150 m, RSV *Aurora Australis*, Stn AA91-100, ANARE, C. C. Lu and T. N. Stranks, 28 Feb 1991, NMV F65680 (mature ♂, 91.6 mm ML); 67°15'S, 68°56'E, 139 m, RSV *Aurora Australis*, Stn AA91-99, ANARE, C. C. Lu and T. N. Stranks, 28 Feb 1991, USNM 884251 (mature ♂, 70.7 mm ML).

Off Amery Ice Shelf, Prydz Bay: 68°00'S, 71°18'E, 515–523 m, MS *Nella Dan*, Stn Prydz-87-20, ANARE, T. G. Cochran, 20 Feb 1987, NMV F65682 (submature ♀, 37.1 and 45.2 mm ML); 66°48'S, 72°33'E, 526–532 m, RSV *Aurora Australis*, Stn AA91-89(2), ANARE, C. C. Lu and T. N. Stranks, 24 Feb 1991, NMV F65615 (submature ♀, 61.1 mm ML; immature ♂, 33.5 mm ML); 66°46'S, 72°37'E, 530 m, RSV *Aurora Australis*, Stn AA91-89, ANARE, C. C. Lu and T. N. Stranks, 24 Feb 1991, NMV F65687 (immature ♂, 20.0 mm ML); 68°30'S, 73°14'E, 743 m, RSV *Aurora Australis*, Stn AA91-80, ANARE, C. C. Lu and T. N. Stranks, 20 Feb 1991, NMV F67886 (submature ♀, 27.5 and 47.6 mm ML; immature ♂, 27.9 mm ML); 66°48'S, 73°31'E,

696–732 m, MS *Nella Dan*, Stn Prydz-87-30, ANARE, T. G. Cochran, 24 Feb 1987, NMV F65683 (mature ♂, 57.3 mm ML); 67°25'S, 74°34'E, 460 m, ANARE, 26 Jan 1986, NMV F65681 (mature ♂, 84.9 mm ML); 67°00'S, 75°01'E, 385–388 m, RSV *Aurora Australis*, Stn AA91-86, ANARE, C. C. Lu and T. N. Stranks, 22 Feb 1991, NMV F67890 (sub-mature ♀, 20.6 and 31.8 mm ML; immature ♂, 23.8 mm ML); 68°26'S, 75°24'E, 616–622 m, RSV *Aurora Australis*, Stn AA91-78, ANARE, C. C. Lu and T. N. Stranks, 19 Feb 1991, NMV F65686 (submature ♀, 35.0 mm ML); 67°01'S, 76°25'E, 327–332 m, RSV *Aurora Australis*, Stn AA91-85, ANARE, C. C. Lu and T. N. Stranks, 22 Feb 1991, NMV F67889 (submature ♀, 24.8 mm ML); 67°21'S, 77°20'E, 337–343 m, MS *Nella Dan*, Stn Prydz-87-40, ANARE, T. G. Cochran, 27 Feb 1987, NMV F65685 (mature ♀, 99.5 mm ML); 67°11'S, 78°16'E, 188–208 m, MS *Nella Dan*, Stn Prydz-87-31, ANARE, T. G. Cochran, 25 Feb 1987, NMV F65684 (submature ♀, 76.3 mm ML).

Diagnosis. Medium sized animals (ML to 100 mm; TL to 350 mm) (fig. 5); mantle spherical to ovoid (MWI 73.6–88.2–100.3); head moderately wide, slightly narrower than mantle (HWI 51.9–72.9–91.0), demarcated from mantle by moderate constriction; eyes large, project above surface of head. Funnel large, stout, bluntly tapered (FuLI 26.2–35.8–44.5); funnel organ VV-shaped, limbs thick, outer limbs as long as median limbs (fig. 9o). Mantle aperture wide (PAI 72.6–99.5–114.6). Arms long (MAI 29.9–44.8–56.0) (1.8–3.6 times ML in mature animals), stout, tapering to fine tips. Arm lengths subequal, arm order usually 4.3.2.1 (ALI, arm 1: 168.5–205.6–289.7; arm 2: 169.7–213.1–321.8; arm 3: 175.9–216.8–334.5; arm 4: 170.2–221.4–329.1). Arm suckers uniserial, raised from arm surface, small (ASI 5.1–7.5–10.3), without sucker enlargement. Third right arm of males hectocotylised, shorter than its opposite number (OAI 77.6–85.6–89.0; HcAI 181.2–211.2–259.5); ligula small, 4–11% of third right arm length in mature animals (LLI 4.7–6.5–10.1); ligula groove long, well marked and shallow, without transverse ridges; calamus long, pointed (CaLI 31.4–43.3–56.4) (figs 9m, n); hectocotylised arm with 36–50 suckers; opposite arm with 37–79 suckers. Web moderately deep (WDI 21.5–24.5–32.1), web formula usually B=C=DAE. Ink sac present. Gill lamellae 8–9. Mature ovarian eggs, from female with enlarged ovary, large (12–14 mm long, 6–7 mm wide) (EgLI 12.6–13.5–14.3; EgWI 6.3–6.7–7.0). Male with long penis (PLI 11.9–35.7–44.5), with single coiled diverticulum (fig. 9p); spermatophores long (SpLI 70.1–118.1–141.4), slender (SpWI 3.8–4.7–6.2), with large, coiled sperm reservoir (SpRI 38.5–44.8–51.3).



Figure 5. *Pareledone harrissoni* (Berry): a, dorsal, and b, lateral, view of USNM 884251, ♂, 70.7 mm ML.

Integument loose and wrinkled, sometimes with gelatinous consistency. Integumental sculpture consists of pattern of fine, rounded and widely scattered papillae on dorsal surface; papillae absent from ventral surface. Large unbranched primary papillae present in ocular region, with one large supraocular papilla. Ventrolateral integumentary ridge absent. In life, colour of resting animals uniformly pink to purple–pink dorsally, cream–white to pale pink ventrally. When stimulated, animals become darker in colour, uniformly brown–pink to brown–purple dorsally, purple–pink ventrally. White spots consist of one spot on mid-dorsal brachial crown. White transverse bar present between eyes. Ocelli absent.

Males mature at approximately 50 mm ML. Females attain ovarian maturity at about 90 mm ML.

Distribution. East Antarctica, from off MacRobertson Land (66°59'S to 67°29'S, 62°49'E to 68°56'E), off the Amery Ice Shelf, Prydz Bay (66°46'S to 68°30'S, 71°18'E to 78°16'E) (this study); and off the Shackleton Ice Shelf (65°06'S to 66°44'S, 95°00'E to 97°28'E) (Berry, 1917). Other distributional records remain to be verified, but the species is probably restricted in distribution to East Antarctic waters. The species has been collected on the Antarctic continental shelf at depths ranging from 25–743 m, with temperatures from -2.1 to -0.6°C, on mud and sand bottoms with pebbles and rocks, and among sponges, gorgonaceans and bryozoans.

Remarks. Apart from *Megaleledone senoi*, *Pareledone harrissoni* is the largest eledonine occurring in East Antarctic waters. The present material, comprises a comprehensive growth series from smaller juveniles to mature males and females. The morphology of the species is somewhat variable in terms of mantle shape, mantle length relative to arm length, and sucker count (e.g. the specimen in fig. 5, USNM 884251, has a relatively low mantle–arm index), although in some cases the variation may be an artefact of preservation techniques.

Voss (1988) designated *P. harrissoni* (Berry) as a *nomen dubium*, but reasons for his decision were not given, nor is it clear whether he personally examined the type specimens. Type material of *P. harrissoni* was examined for this study and although two of the specimens are in a deteriorated condition, the species does have valid characters that may be assessed.

Robson (1932) postulated that *P. antarctica* (Thiele) was the same species as *P. harrissoni*.

The type material of *P. antarctica* was not available for examination, but comparison of the type description and illustrations of *P. antarctica* by Thiele (1920) with the present material suggests that the species is conspecific with *P. harrissoni*. *P. antarctica* is thus a probable junior synonym of *P. harrissoni*.

Pareledone prydzensis sp. nov.

Figures 6, 7, 9q–t

Material examined. Holotype: Antarctica, off Amery Ice Shelf, Prydz Bay (66°48'S, 72°33'E), 526–532 m, RSV *Aurora Australis*, Stn AA91-89(2), ANARE, C. C. Lu and T. N. Stranks, 24 Feb 1991, NMV F65666 (mature ♂, 29.4 mm ML) (preserved in ethyl alcohol).

Paratypes: locality as above, AM C173819 (submature ♀, 25.7 mm ML), NMV F65625 (submature ♀, 20.7 mm ML; mature ♂, 28.2 mm ML), USNM 884249 (mature ♂, 25.8 mm ML).

Other material examined: Antarctica, off Amery Ice Shelf, Prydz Bay: 66°42'S, 71°56'E, 667–676 m, RSV *Aurora Australis*, Stn AA91-92, ANARE, C. C. Lu and T. N. Stranks, 25 Feb 1991, NMV F65614 (immature ♂, 20.9 mm ML); 66°46'S, 72°37'E, 530 m, RSV *Aurora Australis*, Stn AA91-89, ANARE, C. C. Lu and T. N. Stranks, 24 Feb 1991, NMV F65624 (submature ♀, 15.0 mm ML).

Diagnosis. Small animals (ML to 30 mm; TL to 95 mm) (figs 6, 7a); mantle spherical (MWI 78.0–94.0–102.7); head wide, slightly narrower than mantle (HWI 80.4–83.9–87.4), demarked from mantle by slight constriction; eyes large, do not project far above surface of head. Funnel large, stout, bluntly tapered (FuLI 41.3–46.7–51.4); funnel organ VV-shaped, limbs thick, outer limbs three-quarters as long as median limbs (fig. 9s). Mantle aperture very wide (PAI 83.7–106.3–122.2). Arms short (MAI 51.7–58.6–69.4) (1.9–2.3 times ML in mature animals), stout, tapering to narrow tips. Arm lengths subequal, arm order 4=3=2.1 (ALI, arm 1: 134.6–160.0–179.1; arm 2: 140.7–163.5–193.3; arm 3: 138.0–163.8–180.1; arm 4: 137.3–166.6–180.9). Arm suckers uniserial, raised from arm surface, small (ASI 6.0–6.8–7.7), without sucker enlargement. Third right arm of males hectocotylied, slightly shorter than its opposite number (OAI 90.7–94.9–102.0; HcAI 155.4–160.1–169.5) (fig. 7b); ligula medium size, 6–9% of third right arm in mature animals (LLI 6.5–7.5–8.2); ligula groove long, well marked and shallow, without transverse ridges; calamus long, pointed (CaLI 48.5–52.0–54.8) (figs 9q, r); hectocotylied arm with 26–29 suckers; opposite arm with 29–36 suckers. Web deep (43.5–47.4–51.1), web formula usually B=C=DAE. Radula with A₂–3 seri-

ation of the rhachidian (fig. 7f). Ink sac present. Gill lamellae 6–7. Size of mature eggs unknown. Male with long penis (PLI 39.4–41.1–43.9), with single coiled diverticulum (fig. 9t); spermatophores long (SpLI 119.9–123.6–130.6), slender (SpWI 6.0–6.1–6.2), with large, coiled sperm reservoir (SpRI 27.1–30.4–34.3).

Integumental sculpture consists of pattern of fine, rounded and closely set papillae on dorsal surface; ventral surface smooth; no larger papillae appear to be present in ocular region or on dorsal mantle. Ventrolateral integumentary ridge present. In life, colour of resting animals grey–purple to pink–purple on the dorsal mantle and head; darker pink–purple on dorsal brachial crown, web and arms; and cream–white to pink–white ventrally. When stimulated, animals become darker in colour, dark purple–pink on dorsal mantle and head; dark purple–brown to black on dorsal brachial crown, web and arms; and light pink–purple ventrally. White spots consist of one spot on mid-dorsal brachial crown, and one broad spot on mid-dorsal posterior mantle. White transverse bar present between eyes. Ocelli absent.

Males mature at approximately 25 mm ML. No mature females were encountered.

Distribution. Known only from Prydz Bay, off the Amery Ice Shelf, East Antarctica (66°42'S to 66°48'S, 71°56'E to 72°37'E). An inshore species collected at depths ranging from 526–676 m, with temperatures from -2.1 to -0.6°C, on mud and sand bottoms with rocks, and among sponges and gorgonaceans.

Etymology. Named after the type locality, Prydz Bay.

Remarks. This new species can be readily distinguished from the other valid species of *Pareledone* recognised in this paper (see Table 1). It can be distinguished from *P. charcoti* by its smaller absolute size at maturity, the much deeper web comprising about 45% of arm length, and the striking colour pattern of the very dark brachial crown, web and arms. *P. prydzensis* also differs from *P. adeliaeana* by having the head narrower rather than wider than the mantle, the shorter ligula length index, the ligula groove without transverse ridges, the VV- rather than W-shaped funnel organ, a differently shaped penis, and a papillate rather than smooth integument. It can also be distinguished from *P. harissoni* by the lower gill count, and papillate rather than smooth integumental sculpture. *P.*

prydzensis may also be distinguished from the other new species described above, *P. framen-sis*, by a relatively wider head, the shorter relative arm length, and a lower hectocotylised arm sucker count and opposite arm sucker count (see fig. 9, Tables 2, 3).

P. prydzensis can be easily distinguished from other elledonine species on the basis of a combination of characters: a broadly ovoid mantle; skin with a characteristic pattern of fine papillae on the dorsum, and a ventrolateral integumentary ridge; large but not prominent eyes; short, subequal arms (1.9–2.3 times ML in mature animals); small suckers; a deep web (43–51% of arm length); a medium sized ligula (6–9% of third right arm length in mature animals); and 6–7 gill lamellae.

Megaleledone Taki, 1961

Type species. *Megaleledone senoi* Taki, 1961.

Diagnosis. Benthic octopodids. Mantle saccular, without fins. Eight arms lacking cirri, arms with large uniserial suckers, third right arm of males hectocotylised with end of arm clearly differentiated into ligula and calamus, arms tips not otherwise modified. Web very deep and well developed. Funnel organ VV-shaped. Gills well developed, with 10–11 lamellae. Ink sac present. Crop absent. Radula reduced, with unicuspid rhachidian and lateral teeth present, and marginal plates absent.

Megaleledone senoi Taki

Figures 8, 9u–x

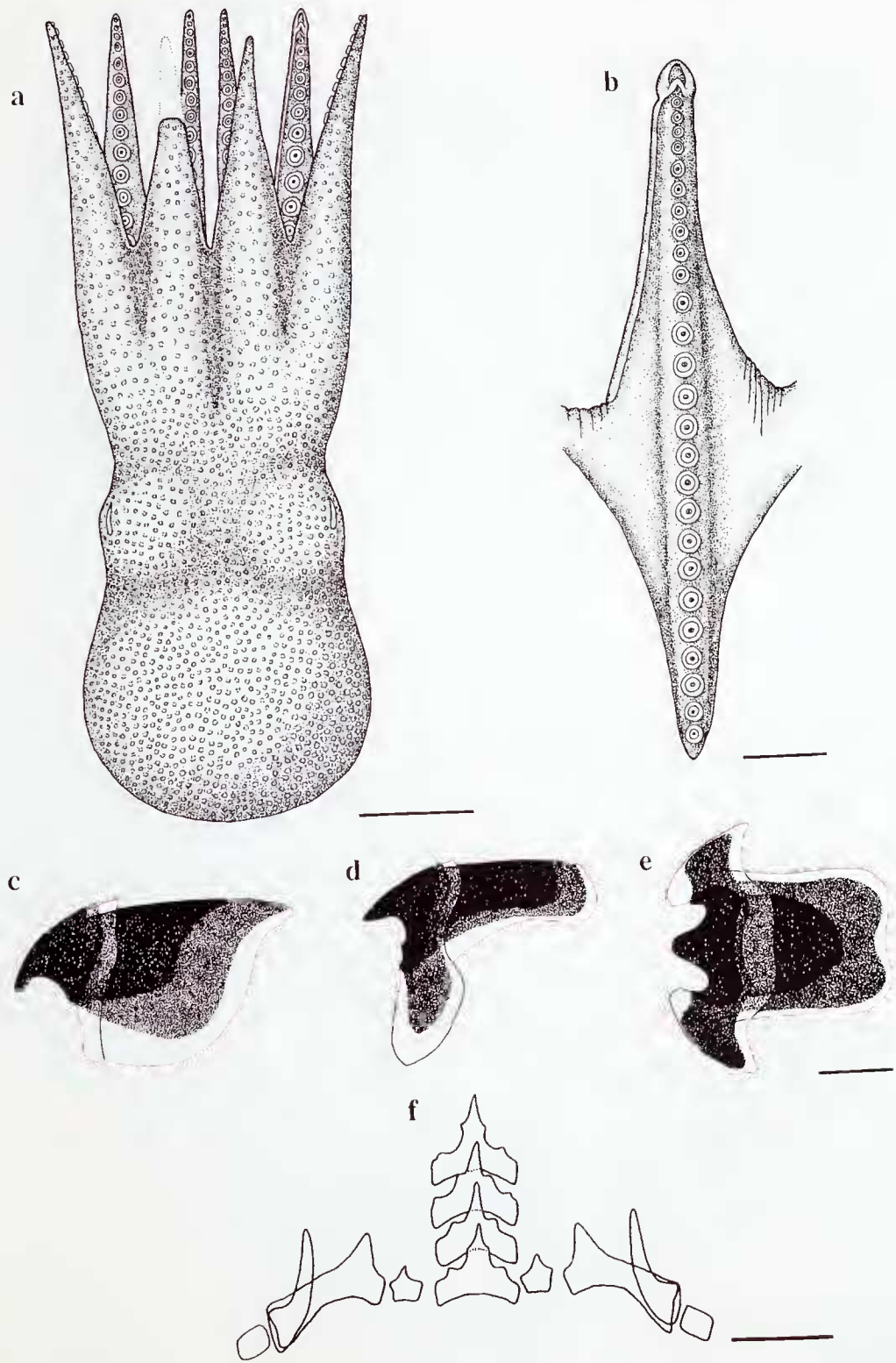
Megaleledone senoi Taki, 1961: 297, text figs 1–8, 16, pls 1, 2. — Kubodera and Okutani, 1986: 133, text fig. 2, pl. 2.

Material examined. Antarctica, off Amery Ice Shelf, Prydz Bay: 66°48'S, 72°33'E, 526–532 m, RSV *Aurora Australis*, Stn AA91-89(2), ANARE, C. C. Lu and T. N. Stranks, 24 Feb 1991, NMV F65529 (submature ♀, 23.6 mm ML); 68°50'S, 73°23'E, 748–761 m, MS *Nella Dan*, Stn Prydz-87-16, ANARE, T. G. Cochran, 20 Feb 1987, NMV F65527 (submature ♀, 131.0 mm ML); 67°19'S, 74°16'E, 464–465 m, MS *Nella Dan*, Stn Prydz-87-47, ANARE, T. G. Cochran, 28 Feb 1987, NMV F65528 (mature ♀, 234.0 mm ML); 67°00'S, 74°23'E, 431–439 m, RSV *Aurora Australis*, Stn AA91-87, ANARE, C. C. Lu and T. N. Stranks, 23 Feb 1991, NMV F60488 (mature ♂, 207.0 mm ML); 67°25'S, 74°34'E, 460 m, ANARE, 26 Jan 1986, NMV F65699 (submature ♀, 30.9 mm ML); 67°00'S, 75°01'E, 385–388 m, RSV *Aurora Australis*, Stn AA91-86, ANARE, C. C. Lu and T. N. Stranks, 22 Feb 1991, NMV F60487 (immature ♂, 169.0 mm ML); 67°54'S, 76°37'E, 431 m, MS *Nella Dan*, Stn Prydz-87-2, ANARE, T. G. Cochran, 16 Feb 1987, NMV F65526 (submature ♀, 181.0 mm ML); 67°21'S, 77°19'E, 333–341 m, RSV *Aurora*



Figure 6. *Pareledone prydzensis* sp. nov.: a, dorsal, and b, lateral, view of NMV F65666, holotype, ♂, 29.4 mm ML.

Figure 7. *Pareledone prydzensis* sp. nov.: a, dorsal view (scale bar = 10 mm), and b, hectocotyliised arm (scale bar = 5 mm), of paratype, USNM 884249, 25.8 mm ML; c, upper beak, d and e, lower beak, of paratype, NMV F65625, ♂, 28.2 mm ML (scale bar = 2 mm); and f, radula of NMV F65614, ♂, 20.9 mm ML (scale bar = 0.2 mm).



Australis, Stn AA91-75, ANARE, C. C. Lu and T. N. Stranks, 17 Feb 1991, NMV F65530 (submature ♀, 44.7, 47.6 and 48.8 mm ML; immature ♂, 42.4 mm ML).

Diagnosis. Large animals (ML to 235 mm; TL to 750 mm) (fig. 8); mantle spherical (MWI 76.0–96.8–106.8); head moderately wide, narrower than mantle (HWI 50.0–65.7–78.0), demarked from mantle by moderate constriction; eyes small, do not project far above surface of head. Funnel large, stout, bluntly tapered (FuLI 33.8–38.8–43.6); funnel organ VV-shaped, limbs thick, outer limbs as long as median limbs (fig. 9w). Mantle aperture very wide (PAI 86.3–119.8–144.3). Arms short (MAI 35.3–41.0–45.7) (2.0–2.6 times ML in mature animals), stout, tapering to narrow tips. Arm lengths subequal, arm order 4=3=2.1 (ALI, arm 1: 188.9–219.7–245.8; arm 2: 195.7–229.6–260.9; arm 3: 198.3–228.4–260.6; arm 4: 204.3–236.1–283.1). Arm suckers uniserial, raised from arm surface, moderately large (ASI 5.9–8.7–18.6), without sucker enlargement. Third right arm of males hectocotylied, slightly shorter than its opposite number (OAI 91.2–92.6–94.0; HcAI 199.1–220.5–259.4); ligula small, 3–4% of third right arm length in mature animals (LLI 3.6); ligula groove long, well marked and shallow, with approximately 10 transverse ridges; calamus long, pointed (CaLI 42.7) (figs 9u, v); hectocotylied arm with 38–40 suckers; opposite arm with 40–69 suckers. Web deep (WDI 40.5–42.7–45.3), web formula usually DCBAE. Ink sac present. Gill lamellae 10–11. Mature ovarian eggs, from female with enlarged ovary, large (18–19 mm long; 7–8 mm wide) (EgLI 7.7–7.9–8.0; EgWI 3.0–3.1–3.2). Males with moderately long penis (PLI 14.7), with single coiled diverticulum (fig. 9x); spermatophore moderately long (SpLI 94.0), slender (SpWI 4.4), with large, coiled sperm reservoir (SpRI 41.4).

Integument thick, loose, wrinkled, with gelatinous consistency. Integumental sculpture consists of pattern of fine, rounded and widely scattered papillae on dorsal surface; papillae absent on ventral surface; no larger papillae in ocular region. Ventrolateral integumentary ridge present. In life, colour of resting animals cream–pink to grey–pink mottled with red–pink patches, and cream–white to pink–white ventrally. When stimulated, animals become darker in colour, dark purple–pink dorsally and light purple–pink ventrally. White spots or bars absent. Ocelli absent.

Males mature at approximately 200 mm ML.

Females attain ovarian maturity at about 230 mm ML.

Type. Holotype, female, 135 mm ML. The specimen has not been located, but may be extant in the Taki family collection, Kyoto, Japan (T. Kubodera, National Science Museum, Tokyo, pers. comm.).

Type locality. Antarctica, off Dronning Maud Land (67°51.5'S, 33°13.5'E), 630–680 m.

Distribution. East Antarctica, from off the Amery Ice Shelf, Prydz Bay (66°48'S to 68°50'S, 72°33'E to 77°19'E) (this study); and from the type locality. West Antarctica, from off the Antarctic Peninsula (61°10'S, 55°55'W) (Kubodera and Okutani, 1986). This species appears to have a circumpolar distribution. The species has been collected on the Antarctic continental shelf at depths ranging from 120–761 m, with temperatures from -1.9 to -1.4°C, on mud and sand bottoms with pebbles and rocks, and among sponges and bryozoans.

Remarks. This collection consists of a large number of specimens of *M. senoi*, from immature to mature male and female specimens. Taki (1961) and Nesis and Propp (1968) reported on mature female specimens, but mature males have not been previously described. The large size of the species clearly sets it apart from the other Antarctic eledonids.

The present material from Prydz Bay does not differ from those specimens described by Taki (1961) or Kubodera and Okutani (1986). Taki (1961) noted the resemblance of *M. senoi* to *Graneledone(?) setebos* Robson, 1932. The latter species is known only from a "single very mangled and decayed specimen" (Robson, 1932: 313), and has not been well diagnosed to date. The holotype from the BMNH collection has not been available for this study, and the validity of the species cannot be presently determined. If *G. setebos* can be adequately characterised, and is found to be conspecific with *Megaleledone senoi*, there are implications for the correct name of the present species as the former name will have priority over Taki's *senoi*.

The diagnostic features of *Megaleledone* (particularly the broad mantle, narrow head, short arms, deep web, high number of gill lamellae, ribbed ligula groove, and absence of crop) distinguish the genus from *Pareledone*. There does not appear to be any good basis for synonymising *Megaleledone* with *Pareledone*, as

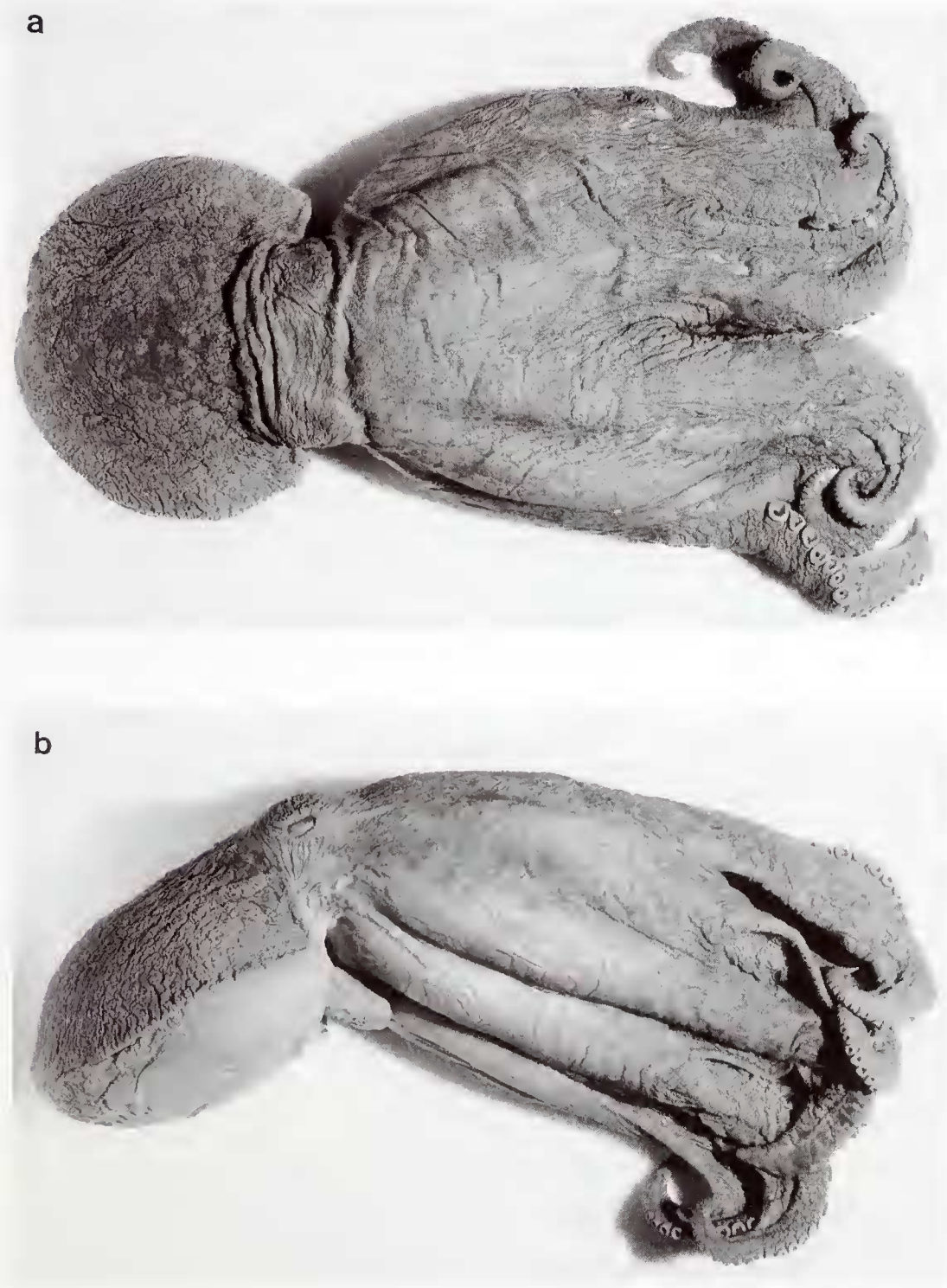
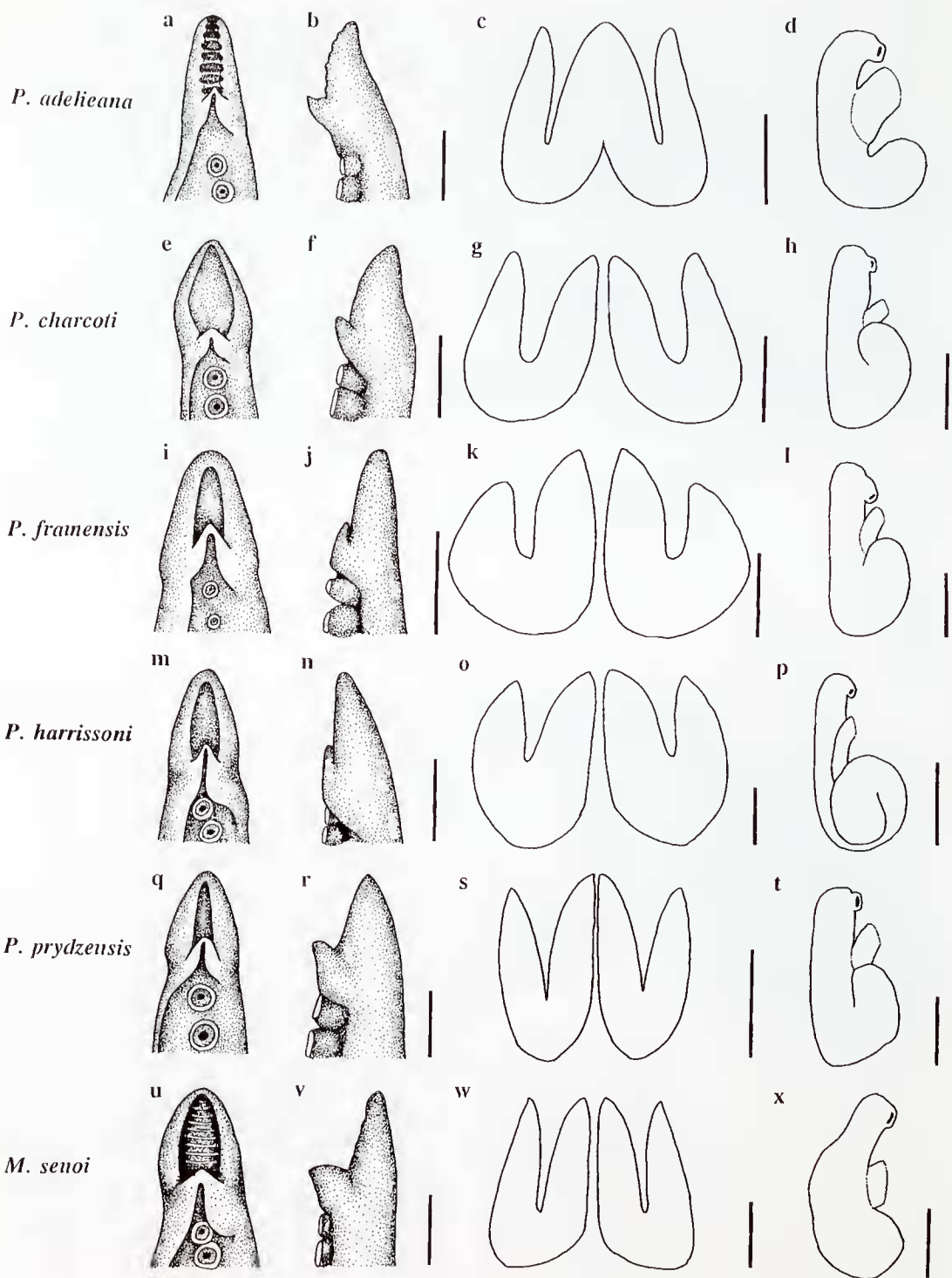


Figure 8. *Megaleledone senoi* Taki: a, dorsal, and b, lateral, view of NMV F60487, ♂, 169.0mm ML.



suggested by Voss (in a personal communication to Palacio, 1978: 289).

Discussion

A large series of specimens, including types of species described by Joubin (1905) and Berry (1917) plus mature males of each species from our collection, has facilitated the present study. Live observations of skin and colour patterns on each described species also benefited our investigation.

Among the 12 nominal species of *Pareledone* currently known, 10 are described from the Southern Ocean, and another two are from the Atlantic Ocean. Of the Atlantic species, *P. nigra* (Hoyle, 1910) was originally described from specimens collected at Lüderitz Bay, Namibia (around 27°S, 15°E). Hoyle (1910) originally placed *nigra* in the *Moschites* genus, but Robson (1932) transferred the species to *Pareledone*. The second Atlantic species, *Pareledone carlgreni* Thore, 1945, was originally diagnosed from material collected at Cape Peninsula, Sea Point, Cape Town, South Africa (~34°S, 15°30'E). Both *P. nigra* and *P. carlgreni* are now being systematically reviewed by Roper and Mangold (in prep.) and should properly be placed in the genus *Aphrodoctopus* (C. F. E. Roper, USNM, pers. comm.).

Once the two Atlantic Ocean species are removed from *Pareledone*, the genus may be considered to have only Antarctic and subantarctic representatives. The 10 nominal species of *Pareledone* from the Southern Ocean are listed in Table 1, with recommendations on their taxonomic status. After examination of available relevant type specimens, additional material and existing published descriptions, five valid species are recognised as occurring in Prydz Bay, East Antarctica: *P. adeliaeana*, *P. charcoti*, *P. framensis*, *P. harrissoni* and *P. prydzensis* (see fig. 9 and Tables 2 and 3 for comparative information). Detailed taxonomic information and full descriptions of these five species, and a key to the species, will be provided with the future publication of a review of the octopods known from the Prydz Bay region.

At an octopod systematics workshop held during the Symposium on Southern Ocean Cephalopods (Cambridge, England, July 1993), two other distinct and separate species of *Pareledone*, *P. polymorpha* and *P. turqueti*, were recognised from West Antarctic waters. These species are not known to occur in waters of East Antarctica.

The present material of *Pareledone* and *Megaleledone* was collected from water depths shallower than 1000m, corresponding with the outer edge of the continental shelf in the Prydz Bay vicinity. Although the collecting effort in deeper waters has in the past been poor, from the very limited data available it is doubtful that the range of either genus extends onto the deeper continental slope. The species were all distributed on soft sandy mud substrates and variously among sponge, gorgonacean and bryozoan faunal communities, in waters approximately -1 to -2°C in temperature.

The absolute and relative sizes of mature eggs in *Pareledone adeliaeana*, *P. charcoti*, *P. harrissoni* and *Megaleledone senoi* were large. Mature eggs of *Pareledone framensis* and *P. prydzensis* were not observed, but judging by the egg development seen in ovaries of submature females, we expect these species to also produce large eggs. Accordingly, we predict that each species will have hatchlings with benthic rather than planktonic development, and thus no potential for long range dispersal (i.e. beyond the Antarctic continent). Ideally this hypothesis would be confirmed

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Figure 9. *Pareledone adeliaeana* Berry: a, oral, and b, lateral, detail of hectocotylus (scale bar = 5 mm), c, funnel organ (scale bar = 5 mm), and d, penis (scale bar = 5 mm), of USNM 884248, 44.8 mm ML. *Pareledone charcoti* (Joubin): e, oral, and f, lateral, detail of hectocotylus (scale bar = 5 mm), g, funnel organ (scale bar = 5 mm), and h, penis (scale bar = 10 mm), of NMV F65695, 52.7 mm ML. *Pareledone framensis* sp. nov.: i, oral, and j, lateral, detail of hectocotylus (scale bar = 5 mm), k, funnel organ (scale bar = 5 mm), and l, penis (scale bar = 10 mm), of holotype, NMV F65665, 58.9 mm ML. *Pareledone harrissoni* (Berry): m, oral, and n, lateral, detail of hectocotylus (scale bar = 5 mm), o, funnel organ (scale bar = 5 mm), of USNM 884251, 70.7 mm ML; p, penis of NMV F65680, 91.6 mm ML (scale bar = 20 mm). *Pareledone prydzensis* sp. nov.: q, oral, and r, lateral, detail of hectocotylus (scale bar = 2 mm), s, funnel organ (scale bar = 5 mm), and t, penis (scale bar = 5 mm), of holotype, NMV F65666, 29.4 mm ML. *Megaleledone senoi* Taki: u, oral, and v, lateral, detail of hectocotylus (scale bar = 10 mm), w, funnel organ (scale bar = 20 mm), and x, penis (scale bar = 20 mm), of NMV F60488, 207.0 mm ML.

Table 1. Taxonomic status of nominal species of *Pareledone* and *Megaleledone* from the Southern Ocean

Species	Status
<i>Pareledone adeliaeana</i> (Berry, 1917)	Valid (previously designated a <i>nomen dubium</i> by Voss, 1988)
<i>Pareledone antarctica</i> (Thiele, 1920)	Probable junior synonym of <i>Pareledone turqueti</i> (Joubin, 1905)
<i>Pareledone aurorae</i> (Berry, 1917)	Junior synonym of <i>Pareledone charcoti</i> (Joubin, 1905)
<i>Pareledone charcoti</i> (Joubin, 1905)	Valid
<i>Pareledone framensis</i> (this paper)	Valid
<i>Pareledone harrissoni</i> (Berry, 1917)	Valid (previously designated a <i>nomen dubium</i> by Voss, 1988)
<i>Pareledone polynorpha</i> (Robson, 1930)	Valid
<i>Pareledone prydzensis</i> (this paper)	Valid
<i>Pareledone turqueti</i> (Joubin, 1905)	Valid
<i>Pareledone unitakae</i> Taki, 1961	Junior synonym of <i>Pareledone adeliaeana</i> (Berry, 1917)
<i>Megaleledone senoi</i> Taki, 1961	Valid

Table 2. Comparison of species of *Pareledone* and *Megaleledone* from Prydz Bay vicinity, Antarctica.

Species	<i>P. adeliaeana</i>	<i>P. charcoti</i>	<i>P. framensis</i>	<i>P. harrissoni</i>	<i>P. prydzensis</i>	<i>M. senoi</i>
Size at Maturity: male	>40 mm ML	>35 mm ML	>50 mm ML	>50 mm ML	>25 mm ML	>200mm ML
female	>45 mm ML	>55 mm ML	?	>90 mm ML	?	>230mm ML
Arm Formula	4.3.2.1	4.3.2.1	4.3.2.1	4.3.2.1	4=3=2.1	4=3=2.1
Arm Length (% of TL)	65–69	60–70	73–77	65–78	66–70	66–72
Hectocotyliised Arm Sucker Count (HASC)	22–28	31–38	44–51	36–50	26–29	38–40
Opposite Arm Sucker Count (OASC)	26–46	37–54	61–80	37–79	29–36	40–69
Ligula Length Index (LLI)	9.7–15.0	5.0–8.1	5.9–7.5	4.7–10.1	6.5–8.2	~3.6
Head Width (% of MW)	88–118	63–72	56–67	68–84	81–83	60–63
Gill Lamellae Count	6–7	7–8	7–8	8–9	6–7	10–11
Egg Length (mm)	8–9*	11–14*	?	12–15*	?	18–19*

*Mature ovarian eggs

Table 3. Comparison of species of *Pareledone* and *Megaleledone* from Prydz Bay vicinity, Antarctica.

Species	<i>P. adeliaeana</i>	<i>P. charcoti</i>	<i>P. framensis</i>	<i>P. prydzensis</i>	<i>P. turqueti</i>	<i>M. senoi</i>
Sculpture	Minor papillation; two longitudinal ridges on posterior mantle; traces of ventrolateral ridge	Finely papillate on dorsum; smoother ventrally; ventrolateral ridge	Coarsely papillate all over; diamond pattern of primary papillae on mantle; very large ocular papillae; no ventrolateral ridge	Finely papillate on dorsum; smoother ventrally; traces of ventrolateral ridge	Minor papillation; loose and wrinkled skin; no ventrolateral ridge	Minor papillation; loose and wrinkled skin; fleshy ventrolateral ridge
Colour	Purplish-red dorsally; paler ventrally	Purplish-brown dorsally; paler ventrally	Golden yellow dorsally; paler ventrally; large white spots and stripes on mantle	Purplish-pink mantle dorsum; dark purplish-brown to black brachial crown, web and arms; paler ventrally	Brownish-pink dorsally; paler ventrally	Dark purplish-pink dorsally; paler ventrally
Other Remarks	Mantle elongate ovoid; head wider than mantle; eyes very large; arms short and stout	Mantle roundly ovoid; head narrower than mantle; arms short and tapering	Mantle roundly ovoid; head narrower than mantle; arms long and tapering	Mantle roundly ovoid; head narrower than mantle; arms short and stout; web very deep	Mantle roundly ovoid; head narrower than mantle; arms long and tapering; skin loose and sometimes slightly gelatinous	Mantle roundly ovoid; head narrower than mantle; arms moderately long and stout; web very deep; skin loose and gelatinous

by the collection of females with egg broods, and live rearing experiments. The species have not been recorded from regions other than the Antarctic continental shelf, and may be classified as endemic elements of the fauna.

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